201-15004

4-Heptanol, 2,6-dimethyl-

(Diisobutyl Carbinol; CAS RN 108-82-7)

High Production Volume (HPV) Chemical Challenge Test Plan and Data Review

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Prepared for:

The Dow Chemical Company

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Test Plan

4-Heptanol, 2,6-dimethyl- **(Diisobutyl Carbinol; CAS RN: 108-82-7)**		Information	OECD Study	GLP	Other Study	Estimation Method	Acceptable	Testing Required
STUDY		**Y/N**	**Y/N**	**Y/N**	**Y/N**	**Y/N**	**Y/N**	**Y/N**
PHYSICAL AND CHEMICAL DATA								
2.1	Melting Point	Y	N	N	Y	N	Y	N
2.2	Boiling Point	Y	N	N	Y	N	Y	N
2.4	Vapor Pressure	Y	N	N	Y	N	Y	N
2.5	Partition Coefficient	Y	N	N	N	Y	Y	N
2.6	Water Solubility	Y	N	Y	Y	N	Y	N
ENVIRONMENTAL FATE AND PATHWAY								
3.1.1	Photodegradation	Y	N	N	N	Y	Y	N
3.1.2	Stability in Water	Y	N	N	Y	N	Y	N
3.3	Transport and Distribution	Y	N	N	N	Y	Y	N
3.5	Biodegradation	Y	Y	Y	N	N	Y	N
ECOTOXICITY								
4.1	Acute Toxicity to Fish	Y	Y	Y	N	N	Y	N
4.2	Toxicity to Daphnia	Y	Y	Y	N	N	Y	N
4.3	Acute Toxicity to Algae	Y	Y	Y	N	N	Y	N
TOXICITY								
5.1	Acute Toxicity	Y	N	N	Y	N	Y	N
5.4	Repeated Dose Toxicity	N	N	N	N	N	N	**Y**
5.5	Genotoxicity *In Vitro* (Bacterial Test)	Y	Y	Y	N	N	Y	N
5.5	Genotoxicity *In Vitro* (Mammalian Cells)	N	N	N	N	N	N	**Y**
5.8	Reproductive Toxicity	N	N	N	N	N	N	**Y**
5.9	Development Toxicity / Teratogenicity	N	N	N	N	N	N	**Y**

4-Heptanol, 2,6-dimethyl-
(Diisobutyl Carbinol; CAS RN 108-82-7)
High Production Volume (HPV) Chemical Challenge
Test Plan and Data Review

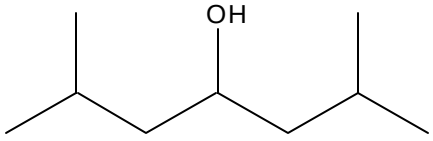
1.0 Introduction

This document provides a Test Plan and reviews the data availability for the High Production Volume (HPV) Chemical Challenge endpoints for 4-Heptanol, 2,6-Dimethyl-, hereafter called Diisobutyl Carbinol [DIBC; CAS RN 108-82-7]. DIBC is sponsored by The Dow Chemical Company.

2.0 General Use and Exposure

Diisobutyl Carbinol (DIBC) has a number of small volume uses. It is commonly used in mining, fabric softeners and textile and paper manufacturing. DIBC also is a lubricant additive intermediate, defoamer in adhesives, a coupling solvent for synthetic resins, a dispersing agent in coatings, and a chemical manufacturing processing solvent. Small amounts of DIBC are used in the fragrance industry as a chemical intermediate in the production of perfumes and/or flavors. Over 90% of the U.S. production of DIBC is as a chemical process solvent in the production of hydrogen peroxide. During 2002, 1 to 3 million pounds of DIBC were produced in the United States.

3.0 General Substance Information (Identity)

Chemical Name	4-Heptanol, 2,6-Dimethyl-
Synonyms	Diisobutyl Carbinol 2,6-Dimethyl heptanol-4 2,6-Dimethyl-4-heptanol 4-Heptanol, 2,6-dimethyl- 4-Hydroxy-2,6-dimethyl heptane Diisobutylcarbinol Nonyl alcohol, secondary sec-Nonyl alcohol
CAS Number	108-82-7
Structure	
Molecular Weight	144.26
Substance Type	Organic
Physical State	Liquid
Odor	Sweet
Purity	2,6-dimethyl-4-heptanol (DIBC) 70% 4,6-dimethyl-2-heptanol (DMH) 30% 2,6-dimethyl-4-heptanone 3%

4.0 Physical/Chemical Properties

A data summary for DIBC is included in Table 1. The Robust Summaries are included in the IUCLID Dataset.

4.1 Melting Point

The melting point for DIBC is listed as –65.2 °C (DIPPR, 2000). This value is considered adequate to meet the HPV Chemical Challenge requirements.

4.2 Boiling Point

The boiling point for DIBC is listed as 177.9 °C (DIPPR, 2000). This value is considered adequate to meet the HPV Chemical Challenge requirements.

4.3 Vapor Pressure

The vapor pressure for DIBC is listed as 0.260 hPa at 20 °C (DIPPR, 2000). This value is considered adequate to meet the HPV Chemical Challenge requirements.

4.4 Partition Coefficient

The log K_{ow} for DIBC is predicted by EPIWIN to be 3.08 (U.S. EPA, 2000a). This value is consistent with the known properties of DIBC and is considered adequate to meet the HPV Chemical Challenge requirements.

4.5 Water Solubility

The water solubility value for DIBC was determined to be 570 mg/L (Wilson, 2000). This value is considered adequate to meet the HPV Chemical Challenge requirements.

5.0 Environmental Fate

A data summary for DIBC is included in Table 1. The Robust Summaries are included in the IUCLID Dataset.

5.1 Photodegradation

The model prediction for atmospheric photodegradation provides a second order rate of reaction with hydroxyl radicals of 18.7 E-12 cm^3/molecule-sec and a $t_{1/2}$ of 6.9 hours (U.S. EPA, 2000b). Because of the nature of use of DIBC, photodegradation is of minimal importance to the overall environmental fate. Rapid degradation from accidental release to the atmosphere, however, is anticipated based on the modeling. These data are considered adequate to meet the HPV Chemical Challenge requirements.

5.2 Stability in Water

DIBC does not react with water; the only functionality other than carbon-carbon and carbon-hydrogen bonds is the hydroxyl group, which does not hydrolyze.

5.3 Transport and Distribution

The Level III fugacity model (U.S. EPA, 2000c) was used to predict the distribution of DIBC released into the environment. Environmental exposure to DIBC is limited based on the use patterns as an industrial intermediate and solvent. For example, DIBC is not listed on the Toxic Release Inventory. Therefore, only accidental releases were considered for the fugacity modeling. Two scenarios, 100% release to air and 100% release to water were examined. For the air release, the model predicted a distribution of 90% into atmosphere, 8% into water, 2% into soil, and < 1% into sediment. For the water release, the model predicted a distribution of 1% into atmosphere, 97% into water, < 0.1% into soil, and 1% into sediment. These data are considered adequate to meet the HPV Chemical Challenge requirements.

5.4 Biodegradability

A study measuring the biodegradation of DIBC in an OECD 301F respirometer test under aerobic conditions for 28 days found that the DOC removal was 99.5% by Day 28; the ThOD reached 10% by Day 8 and 53% in the next 10 days, attaining 60% by Day 28. The author concluded that DIBC is not readily biodegradable because the strict criterion for the 10-day window was not met (Heim, 2003). DIBC can be classified as inherently biodegradable and nearly meets the criteria for ready biodegradation in this test system. These data are considered adequate to meet the HPV Chemical Challenge requirements.

6.0 Ecotoxicity

A data summary for DIBC is included in Table 1. The Robust Summaries are included in the IUCLID Dataset.

6.1 Toxicity to Fish

The 72- and 96-hour LC_{50} value for DIBC toxicity to freshwater fish (rainbow trout; *Oncorhynchus mykiss*) is reported as 28.6 mg/L (Marino and Yaroch, 2002a). The study was conducted in compliance with EPA OTS Guideline 797.1400 except that DIBC concentrations were not measured in the test solutions and nominal values were used throughout. Because DIBC does not hydrolyze, the nominal concentrations are acceptable and this LC_{50} value is considered adequate to meet the HPV Chemical Challenge requirements.

6.2 Toxicity to Aquatic Invertebrates

The 48-hour EC_{50} value for DIBC toxicity to *Daphnia magna* is 47.8 mg/L (Marino and Yaroch, 2002b). The study was conducted in compliance with EPA OTS Guideline 797.1300 except that DIBC concentrations were not measured in the test solutions and nominal values were used throughout. Because DIBC does not hydrolyze, the nominal concentrations are acceptable and this EC_{50} value is considered adequate to meet the HPV Chemical Challenge requirements.

6.3 Toxicity to Aquatic Plants

The 96-hour EC_{50} values for DIBC toxicity based on biomass and growth rate to *Selenastrum capricornutum* (algae) are 7.41 and 29.95 mg/L, respectively (Roshon, 2002). The study was conducted in compliance with OECD Guideline 201. These data are considered adequate to meet the HPV Chemical Challenge requirements.

7.0 Human Health-Related Data

A data summary for DIBC is included in Table 1. The Robust Summaries are included in the IUCLID Dataset.

7.1 Acute Toxicity

The following acute toxicity data are available: acute oral LD_{50} in rats = 3560 mg/kg bw; acute dermal LD_{50} in rabbits = 4591 mg/kg bw; no deaths from an 8-hr exposure to substantially saturated vapor or cooled mist of DIBC (Carpenter, 1948). These data are considered adequate to meet the HPV Chemical Challenge requirements.

7.2 Repeated Dose Toxicity

No data were identified for repeated dose toxicity. An oral (gavage) study using OECD Guideline 422 is in progress.

7.3 Genetic Toxicity (*in vitro*)

DIBC has been shown to be negative in a high quality Bacterial Reverse Mutation assay for *Salmonella* and *E. coli* strains with and without metabolic activation (Mecchi, 2002). A study to evaluate chromosomal aberrations using OECD Guideline 473 is in progress.

7.4 Reproductive and Developmental Toxicity

No data were identified for reproductive or developmental toxicity. An oral (gavage) study using OECD Guideline 422 is in progress.

8.0 Conclusion

Adequate information is available for melting point, boiling point, vapor pressure, partition coefficient and water solubility for DIBC. Photodegradation and environmental distributions are adequately supported by the appropriate model data. DIBC does not have hydrolyzable groups and is stable in abiotic aqueous systems and is biodegradable. Aquatic toxicity data are available for fish, daphnia and algae indicating that DIBC is moderately toxic to aquatic organisms. DIBC is relatively non-toxic via acute oral, dermal and inhalation exposure. In bacterial cell systems, DIBC is not mutagenic. Additional testing is in progress for repeated dose, reproductive and developmental screening using the OECD 422 protocol. In addition, a chromosomal aberration assay (OECD 473) is in progress. The available data and the studies in progress are considered adequate to meet the HPV Challenge Program requirements.

9.0 References

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Table 1: HPV Data Summary

4-Heptanol, 2,6-Dimethyl-
(Diisobutyl Carbinol; DIBC)

CAS RN: 108-82-7		SPECIES	PROTOCOL	RESULTS
PHYSICAL-CHEMICAL				
2.1	Melting Point		Handbook Data (DIPPR)	-65.2 °C
2.2	Boiling Point		Handbook Data (DIPPR)	177.9°C
2.3	Density		Handbook Data (DIPPR)	0.8112 g/cm^3 (at 20 °C)
2.4	Vapor Pressure		Handbook Data (DIPPR)	0.260 hPa (at 20 °C)
2.5	Partition Coefficient (log K_{ow})		KOWWIN v 1.66	3.08
2.6	Water Solubility		ASTM E 1148	570 mg/L (at 20 °C)
2.7	Flash Point		Handbook Data (DIPPR)	65.85 ºC
ENVIRONMENTAL FATE AND PATHWAY				
3.1.1	Photodegradation		AOPWIN v. 1.90	half-life: 6.9 hours (OH Rate Constant)
3.1.2	Stability in Water		Hydrolysis @ 25 °C	Does not react with water; the only functionality other than carbon-carbon and carbon-hydrogen bonds is the hydroxyl group which does not hydrolyze
3.3	Transport and Distribution		Mackay Level III 100% release to air;	90% into atmosphere, 8% into water, 2% into soil, < 1% into sediment
			Mackay Level III 100% release to water	1% into atmosphere, 97% into water, < 0.1% into soil, 1% into sediment
3.5	Biodegradation		OECD 301F	ThOD = 60% after 28 days
ECOTOXICOLOGY				
4.1	Acute/Prolonged Toxicity to Fish	*Oncorhynchus mykiss*	OTS 797.1400	LC_{50} (96 hours) = 28.6 mg/L
4.2	Acute Toxicity to Aquatic Invertebrates	*Daphnia magna*	OTS 797.1300	EC_{50} (48 hours) = 47.8 mg/L
4.3	Toxicity to Aquatic Plants e.g. Algae	*Selenastrum capricornutum*	OECD Guideline 201	EC_{50} (96 hours) 7.41 mg/L (biomass) 29.95 mg/L (growth rate)

Table 1: HPV Data Summary

4-Heptanol, 2,6-Dimethyl-
(Diisobutyl Carbinol; DIBC)

CAS RN: 108-82-7		SPECIES	PROTOCOL	RESULTS
TOXICOLOGY				
5.1.1	Acute Oral Toxicity	Rat		LD50 : 3560 mg/kg bw
5.1.2	Acute Inhalation Toxicity	Rat		No deaths following 8-hr exposure to saturated vapor or cooled mist
5.1.3	Acute Dermal Toxicity	Rabbit		LD_{50}: 4591 mg/kg bw
5.4	Repeated Dose Toxicity	Rat	OECD 422	Study in progress
5.5	Genetic Toxicity *In Vitro*			
	Bacterial Test (Gene mutation)	*S. typhimurium and E. coli*	OECD 471	Negative
	Chromosomal Aberration	CHO	OECD 473	Study in progress
5.8	Toxicity to Reproduction / Impairment of Fertility	Rat	OECD 422	Study in progress
5.9	Developmental Toxicity / Teratogenicity	Rat	OECD 422	Study in progress